COMPARISON OF THE ESSENCES FROM NINE VARIETIES OF APPLES

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A process for recovering in concentrated form the volatile, fragrant constituents of apple juice has been described by Milleville and Eskew.[2] This volatile fraction, called essence, is highly important in contributing to the typical flavor of apple products. We would go so far as to say that an apple product which has lost its essence does not have a typical apple flavor; an apple product that has retained the volatile fraction or has had it returned does have a typical apple flavor. One of the first questions that arises is, How different are the essences prepared from different varieties? Persons who are thoroughly familiar with apple varieties can identify some of them by their aroma alone. It would be expected that essences from single varieties would differ both quantitatively and qualitatively, and information on this point would be of use in the selection of varieties for commercial production. The present paper is a report on essences prepared from one lot of each of nine varieties from the 1945 crop.

Preparation of Essences

Apples of all varieties except the Red Delicious were purchased locally and held in cold storage for 2 to 2-1/2 months before processing. The Red Delicious apples were obtained from Wenatchee, Washington, and held in cold storage for 3 months. The apples were carefully sorted before processing. Table 1 gives details of the condition of the apples, the percentage discarded being taken as a measure of the spoilage during storage. The effect of ripeness on the quality of essence has not yet been investigated.

The apples were processed in batches of 21 to 50 bushels each. The fruit was sorted, given a warm acid wash, rinsed and crushed in a hammer mill. The juice was expressed in a hydraulic press and screened. The essence was then recovered by the rapid evaporation of about 10 percent of this juice and fractionation of the vapors, as described in AIC-63.[2] All essences were produced under essentially the same conditions. In each case the concentration was about 150-fold, that is the volatile aromatic constituents were 150 times as strong as in the original juice.

Table 1. Condition of Apples Processed

Variety	Ripeness[a]	Discarded After Storage	Acidity of Juice[b]
		%	
Golden Delicious	Ripe, slightly shrunken	3.4	0.21
Stayman-Winesap	Ripe	3.0	0.47
Red Delicious (from Wenatchee, Wash.)	Firm ripe	1.5	0.16
McIntosh	Ripe	1.9	0.45
Grimes Golden	1/3 ripe, 2/3 firm ripe	3.4	0.35
Jonathan	Slightly overripe	13.6	0.44
Baldwin	40% ripe, 60% immature, scabby and shriveled	0.03	0.59
Northern Spy	Mixed ripe and firm ripe	2.5	0.46
Rhode Island Greening	Mixed ripe and firm ripe	0.3	0.73

a According to U. S. standards for apples.
b Calculated as per cent malic acid adjusted to 12.5° Brix.

1. One of the Laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.
2. Recovery and Utilization of Natural Apple Flavors, by H. P. Milleville and R. K. Eskew. Bureau of Agricultural and Industrial Chemistry AIC-63, 1944 [Processed].

Since direct comparison of the essences by their aromas is difficult, we incorporated them into final products for comparison. These products--apple candy, apple jelly and full-flavored apple concentrate reconstituted into beverage juice--not only furnish adequate means for comparing the quality of the individual essences, but they represent promising commercial possibilities for apple essence.

Apple candy: The standard formula, previously developed for apple candy of the pectin gum type, was used. Care was taken to make the batches as nearly identical as possible so that the variety of essence would be the only variable. The formula and method of preparation were as follows:

Formula

Slow-setting pectin (180 grade)	5 g
Water	200 ml.
Sugar	171 g
Corn sirup (unmixed)	171 g
Sodium citrate	1 g
Citric acid	2 g
Apple essence (150-fold)	10 ml.
Apple concentrate, 78° Brix	30 g

Preparation

1. Bring water to boil
2. Mix pectin with half of sugar and add slowly to the water, stirring constantly to avoid lumping.
3. Add the sodium citrate, (dissolved in a few ml. of water).
4. Add corn sirup and rest of the sugar.
5. Cook to 108° C.
6. Remove from the fire and cool to 95° C. Combine the apple essence with the apple concentrate and add slowly to the batch. Stir thoroughly.
7. Add the citric acid (dissolved in a few ml. of water) stirring constantly.
8. Turn out immediately on a greased slab.
9. Mark in squares and sugar.

Apple Jelly: The formula and method of preparation for apple jelly were:

Formula

Concentrated depectinized apple juice (78° Brix) (from blend of 50% Stayman Winesap and 50% McIntosh)	330 g
Water	1500 g
Pectin (200 grade)	13 g
Citric acid solution (21%)	90 ml.
Apple essence (150-fold)	42 ml.
Sugar	2500 g

Preparation

1. Mix water and concentrate and bring to boil.
2. Add pectin mixed with sugar, stirring constantly.
3. Add remaining sugar; bring to boil.
4. Cook to 68% solids.
5. Cool to 210° F.
6. Remove scum.
7. Add mixture of 1% essence and 0.5% citric acid to jars.
8. Pour jelly over mixture, seal and shake immediately to prevent loss of essence and to mix contents.

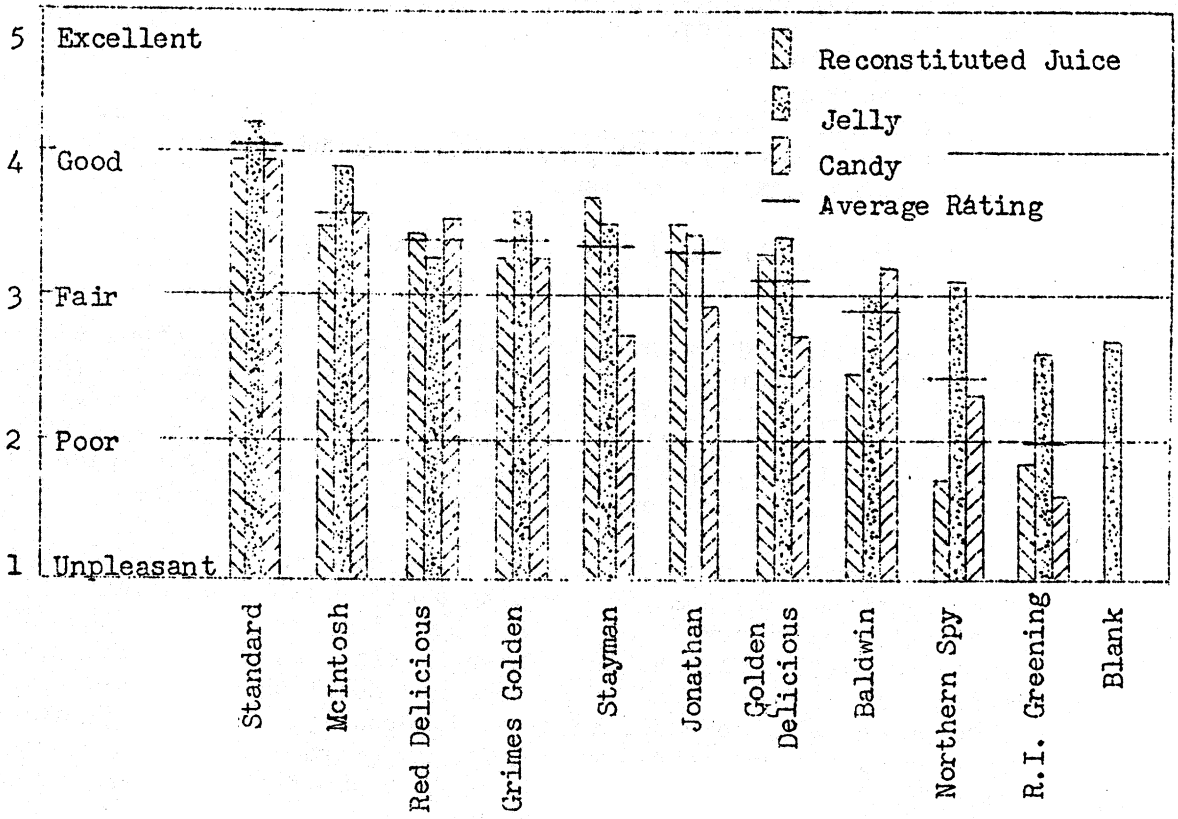
The final jelly contains 65% sugar solids.

Reconstituted Apple Juice: The concentrate was prepared from 64% Stayman and 36% McIntosh juice by screening it through 200 mesh, stripping off the essence in the usual way, and evaporating in vacuum to 55° Brix. This concentrate was used for comparing all the essences by returning the appropriate amount of essence and diluting with water to 12.5° Brix. Since the essences were 150-fold, there was one part of essence in 150 parts of reconstituted juice.

All products were submitted to our regular taste panel of about 15 people for evaluation. The numerical rating scale was: 5, excellent; 4, good; 3, fair; 2, poor; 1, objectionable or unpleasant. In order to make the evaluation simpler, a standard essence was included in each series as a basis for comparison. This standard was a 50-50 blend of Stayman and McIntosh essences, which in many previous tests had been conceded to be a high-quality product. In the candy and the juice series the standard was arbitrarily graded 4. In the jelly series the tasters graded the standard sample as they saw fit. A blank jelly containing no essence was also included for comparison.

The results are shown graphically in the chart. The standards should probably have been rated higher than "4" as they contained an excellent essence. If this had been done, the other samples would have been rated correspondingly higher. Therefore, it should be interpreted that some of the essences were undoubtedly grade 4 or higher.

EVALUATION OF NINE VARIETIES OF APPLE ESSENCE IN CANDY, JELLY, and JUICE



Conclusions and Summary

1. The essences from nine varieties of apples were prepared and incorporated into candy, jelly, and reconstituted juice for comparison. The aroma of each essence is characteristic of the variety of apple from which it is produced.

2. Varieties of apples differ considerably in the quality of their essence. These differences are greater in candy and in juice than in jelly, probably because this type of candy and the reconstituted juice would be practically worthless without added essence - so much so that blanks were not included here - while the blank jelly was rated 2.7. McIntosh, Red Delicious, Grimes, Golden, Stayman and Jonathan essences were the most desirable; Golden Delicious and Baldwin essences were intermediate; and Northern Spy and Rhode Island Greening were least desirable.

3. Blends are likely to make more successful essence than the juice of single varieties. In none of the three products was any single variety as good as the standard blend of Stayman and McIntosh. We believe each variety produces such a characteristic essence that, by itself, it does not seem as typically "apple" as the blend. This is well illustrated in the case of the Jonathan used in reconstituted juice; four tasters rated it 5,

another four rated it 2, and the average was 3.5. On the other hand, both Northern Spy and Rhode Island Greening were consistently rated 2, almost unpleasant, for juice.

4. In producing a blend of apple essence, Northern Spy could be used to a limited extent, but Rhode Island Greening has doubtful value. Most reliance, however, should be placed not only on the other varieties of apples listed, but no doubt on many standard varieties not tried in these tests.

So much for the comparison of varieties. Certain other conclusions based on this work should be mentioned:

5. Apple candy of the gum type is a promising new confection, made possible by apple essence. It has a refreshing "fresh-apple" flavor, well received by many hundreds of people who have tasted it. Without the essence, however, it is truly a "blank".

6. The "full-flavored apple concentrate" described above is another promising outlet for apple essence. The beverage made by adding water to it compares favorably with freshly pressed apple juice.

7. Apple jelly made with added essence is much fruitier in flavor than that made without it. We feel that such apple jelly will join the ranks of the most highly regarded fruit jellies of any kind.